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Exploring Mothers' Influence on Preschoolers' Physical Activity Levels and Sedentary Time

Alana M. Maltby
The University of Western Ontario

Supervisor
Dr. Patricia Tucker
The University of Western Ontario

Graduate Program in Health and Rehabilitation Sciences
A thesis submitted in partial fulfillment of the requirements for the degree in Master of Science
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EXPLORING MOTHERS' INFLUENCE ON PRESCHOOLERS' PHYSICAL ACTIVITY
LEVELS AND SEDENTARY TIME

(Thesis format: Monograph)

by

Alana M. Maltby

Graduate Program in Health and Rehabilitation Sciences

A thesis submitted in partial fulfillment
of the requirements for the degree of
Master's of Science

The School of Graduate and Postdoctoral Studies
The University of Western Ontario
London, Ontario, Canada

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Abstract

Physical activity (PA) patterns continue from childhood into adulthood; therefore, establishing healthy PA levels early is imperative. Mothers have been identified as influencing preschoolers' activity behaviours; however, a holistic exploration of maternal influence is lacking. The purpose of this study was to explore maternal influence on preschoolers' PA and sedentary time. Preschoolers ($n = 30$) and their mothers wore Actical™ accelerometers, and mothers completed the adapted Environmental Determinants of Physical Activity in Preschool Children - Parent Survey. Direct entry regression analyses were conducted to explore maternal influence (e.g., support, enjoyment) on preschoolers' activity levels. Maternal support was a significant predictor of preschoolers' PA and sedentary time ($p < .05$), while mothers' enjoyment of PA was related to preschoolers' sedentary time, light PA, and total PA ($p < .05$). Further research using a large diverse sample is warranted to clarify and understand the ways in which mothers impact their preschoolers' PA behaviours.

Keywords: Physical activity, sedentary time, preschooler, maternal influence, accelerometry, health promotion

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Chapter 1: Introduction and Literature Review

Physical activity is an integral part of young children's health and wellbeing, and yet, many children do not accrue adequate amounts to gain the associated health benefits (Colley et al., 2013; Goldfield, Harvey, Grattan, & Adamo, 2012). Physical activity is defined as any bodily movement by the skeletal muscles that cause energy expenditure (Caspersen, Powell, & Christenson, 1985), whereas sedentary behaviour, independent of physical activity, is defined as activity that involves minimal physical movement and low energy expenditure (<1.5 metabolic equivalent tasks [METs]; Tremblay, Colley, Saunders, Healy, & Owen, 2010).

Patterns of low moderate-to-vigorous physical activity (MVPA) and lengthier time in sedentary activities have become increasingly common among the preschool population (i.e., those aged 2.5-5 years; Cardon & De Bourdeaudhuij, 2008; Dolinsky, Namenek Brouwer, Evenson, Siega-Riz, & Østbye, 2011; Reilly, 2008; Taylor et al., 2009). In a study involving 1,004 Australian preschoolers, Hinkley and colleagues (2012) found that for each year a child gets older, he or she spends approximately 10% less time being physically active (Hinkley, Salmon, Okely, Hesketh, & Crawford, 2012). Comparably, Edwards et al. (2013) conducted a longitudinal study and found that between the ages of 5-7, rates of physical activity significantly declined, while sedentary time increased. Concurrent to the low levels of physical activity participation among children, an increase in sedentary behaviours (e.g., screen viewing, prolonged sitting, etc.) has been postulated to predispose young children to health risks including increased adiposity, and negative impacts on psychosocial health and cognitive development (Leblanc et al., 2012). Routine sedentary behaviours may become ingrained in a child's

lifestyle through reinforcement (Epstein & Roemmich, 2001), and therefore, opportunities for higher levels of physical activity and reduced sedentary activity should be established and encouraged at a young age (Reilly et al., 2004).

Researchers have indicated that physical inactivity is a determinant of metabolic health and cardiovascular risk in young children (Suriano, Curran, Byrne, Jones, & Davis, 2010). As such, the current inactivity levels coupled with the high sedentary time among young children are disconcerting given that physical activity during childhood is vital for both physiological and psychosocial health and development (Pellegrini & Smith, 1998; Timmons, Naylor, & Pfeiffer, 2007). Promoting habitual physical activity early in life is important for the prevention and reduction of increased bodyweight (Goran, Reynolds, & Lindquist, 1999; Moore et al., 1995). Specifically, physical activity is a modifiable behaviour that helps maintain energy balance through energy expenditure; participating in physical activity helps to protect against overweight and obesity (Ebbeling, Pawlak, & Ludwig, 2002; Kohl & Hobbs, 1998; Lobstein, Baur, & Uauy, 2004; Reilly, 2008). With the prevalence of overweight and obesity occurring more frequently among young children (de Onis, Blossner, & Borghi, 2010), additional focus is needed to improve the trajectory of physical and sedentary activity behaviours within this population.

The Benefits of Physical Activity in the Early Years

It is critical to establish physical activity habits and to regulate energy balance in the early years of childhood (Olstad & McCargar, 2009), given that the onset of overweight and obesity is occurring as young as 2 years of age (Shields, 2006). In the Framingham Study (Moore et al., 1995), researchers examined physical activity and body

fat in young children (aged 3-5 years; $n = 97$) and found that inactive children gained significantly more body fat than more active children; this was especially true for those with greater adiposity at baseline (Moore et al., 1995). Similarly, Proctor et al. (2003) indicated that children who were the most sedentary and watched greater amounts of television gained more body fat from ages 4 to 11 years than those children who were more active and spent less time watching television. Vale and colleagues (2013) explored physical activity guideline adherence and weight status among Portuguese preschool children (aged 4-6 years; $n = 607$) and found that girls who participated in low levels of daily MVPA were more likely to be classified as overweight (Vale et al., 2013). Moreover, Collings et al. (2013) suggested that vigorous physical activity had a strong inverse association with lower adiposity among 4-year olds ($n = 398$) from the United Kingdom. Consequently, in order to sustain adequate activity levels and prevent adiposity gains among this population, encouraging physical activity that is engaging and enjoyable is necessary for this behaviour to become routine (Borra, Kelly, Shirreffs, Neville, & Geiger, 2003; Tucker & Irwin, 2010).

It is important to note that being regularly active during childhood also has positive implications beyond maintaining a healthy bodyweight (Timmons et al., 2007; Tremblay et al., 2012a). The benefits of physical activity are also evident for bone and skeletal health (Janz et al., 2001; Kohrt, Bloomfield, Little, Nelson, & Yingling, 2004); cardio-metabolic health (Ekelund et al., 2012; Saakslahti et al., 2004; Twisk, Kemper, & van Mechelen, 2002); motor skill development (Fisher et al., 2005; Pellegrini & Smith, 1998; Williams et al., 2008); and improved psychosocial and cognitive wellbeing (Burdette & Whitaker, 2005; Pellegrini & Smith, 1998). Given the multitude of health

advantages associated with being active, promoting adequate participation in physical activity and minimizing sedentary behaviour during early childhood appears to be an important option to enhance overall health and development throughout the lifespan (Hodges, Smith, Tidwell, & Berry, 2013; Lobstein et al., 2004; World Health Organization, 2010).

Finally, the promotion and encouragement of regular physical activity during early childhood is important for this health-related behaviour to continue throughout the lifespan (Kohl & Hobbs, 1998; Tremblay et al., 2012a). According to Clark (2005, p. 41), “early experiences can be seen as critical to the foundation or building blocks upon which our later motor skills are built.” Preschoolers develop essential patterns of movement that provide the foundation for a range of physical activities in later childhood and adolescence (Strong et al., 2005). This development is crucial as the effects of physical activity are vast and can impact multiple systems within the body. Specifically, regular physical activity participation can be beneficial for musculoskeletal and cardiovascular health, adiposity, hypertension, and regular physical activity also lowers the risk of early mortality in adulthood (Strong et al., 2005; Warburton, Nicol, & Bredin, 2006).

Physical Activity and Sedentary Behaviour Guidelines for the Early Years

Recently, with the involvement of various stakeholders (such as scientists, guideline developers and future guideline users [e.g., health professionals, government and non-governmental organizations, parents, etc.]), the Canadian Society for Exercise Physiology (CSEP) developed the first Canadian Physical Activity (Tremblay et al., 2012a) and Sedentary Behaviour Guidelines for the Early Years (Tremblay et al., 2012b), targeting children aged 0-4 years. These recommendations state that toddlers (aged 1-2

years) and preschoolers (aged 3–4 years) should accumulate 180 minutes of physical activity each day, at *any* intensity (e.g., light, moderate, or vigorous). The physical activity guidelines emphasize that all types of activity are important when children are young and that greater levels of physical activity provide additional benefits for growth and development (Timmons et al., 2007; Tremblay et al., 2012a). The Canadian recommendation for preschoolers' physical activity is on par with the guidelines forwarded by Australia (Australian Government, 2010) and the United Kingdom (Start Active, Stay Active, 2011). As children approach the age of 5, they should progress towards a minimum of 60 minutes of energetic play or MVPA daily (e.g., hopping, jumping, skipping, biking, running, etc.; Tremblay et al., 2012a). The sedentary behaviour guidelines endorsed by CSEP, the first recommendations of their kind, encourage preschoolers (2–4 years) to minimize prolonged sitting (e.g., in a stroller or car seat) to less than an hour at a time and limit screen viewing for children to less than one hour per day (Tremblay et al., 2012b).

Physical Activity Levels Among Preschoolers

As stated, the new CSEP guidelines support activity participation at any intensity (Tremblay et al., 2012a). Two recent Canadian studies (Gabel et al., 2013; Obeid, Nguyen, Gabel, & Timmons, 2011), with a small number of participants ($n = 133$; $n = 33$, respectively), found that the majority of preschoolers were meeting the recently implemented activity guidelines of 180 minutes per day. Similarly, data from the 2009–2011 Canadian Health Measures Survey revealed that 84% of preschool-aged children (3–5 years old; $n = 459$) met the current Canadian physical activity guideline (Colley et al., 2013). The high levels of activity observed in Colley et al.'s study could be a

consequence of measurement differences (e.g., Colley and colleagues used a 1-minute epoch while many other researchers have used a shorter observation timeframe – this may have resulted in the increased misclassification of physical activity data) or cut points applied. For example, using a 15-second epoch length, Vanderloo and colleagues (2014) found that preschoolers ($n = 31$) in centre-based childcare accrued minimal levels (11.45 minutes) of MVPA and did not meet the guidelines for total physical activity (TPA; 132.20 minutes) during the 7.5 hours spent in these care facilities (Vanderloo et al., 2014).

While the majority of preschoolers in the above noted studies did in fact achieve the recommendation for their age group, Colley et al.'s study found that only 11% of 3 and 4 year olds participated in 60 minutes of MVPA during the 180 minutes of accumulated daily activity. This finding indicates that many children will unlikely progress to the recommended 60 minutes of daily MVPA recommended at age 5 (Colley et al., 2013). The minimal levels of MVPA at a young age are troublesome given that activity levels tend to decline further as children age (Colley et al., 2013; Hinkley et al., 2012). Low levels of MVPA among young children (aged 2-6 years; $n = 10, 316$) were also noted in a large systematic review by Tucker (2008). This review, consisting of 39 international studies, revealed that only 54% achieved 60 mins/day of MVPA. The participation rates in London, Ontario were similar, with 55% of preschoolers having reached 60 mins/day of MVPA (Tucker & Irwin, 2010). In Belgium, Cardon and De Bourdeaudhuij (2008) found even lower levels of MVPA, with only 7% of preschoolers (aged 4-5; $n = 76$) engaged in 60 mins/day. Moreover, only 26% of these preschoolers accrued 120 minutes of daily activity. Hesketh et al. (2014a) conducted a study in the

United Kingdom involving 593 preschoolers (4 years old) using accelerometry, and found that 88% participated in low intensity physical activity throughout the day; however, they all met the recommended guideline of 180 minutes. Given the low participation in MVPA activity during young childhood (Reilly et al., 2004; Tucker, 2008), health promotion initiatives are needed to help optimize higher intensity physical activity levels for children's optimal growth and development (Hinkley et al., 2012; Strong et al., 2005; Tucker & Irwin, 2010). Furthermore, tailoring these strategies to consider sex differences in the activity levels of preschool children is necessary, as boys are frequently reported as being more active than girls (Finn, Johannsen, & Specker, 2002; Oliver, Schofield, & Kolt, 2007; Pate, Pfeiffer, Trost, Ziegler, & Dowda, 2004; Tucker, 2008).

Activity preferences. Preschoolers' activity preferences differ depending on the age (Pellegrini & Smith, 1998), and personality of the child (Buss, Block, & Block, 1980). For example, Buss and colleagues (1980) found that preschoolers who were more active tended to be more outgoing, whereas preschoolers who were less active were more likely to be socially withdrawn. Furthermore, unlike older children and adults, preschoolers are often physically active by engaging in different forms of free, intermittent, unstructured play (Ginsburg, 2007; Pellegrini & Smith, 1998) involving more omnidirectional movements (such as rolling and climbing; Oliver et al., 2007). Pellegrini and Smith (1998) suggested that preschool children most commonly partake in exercise play, which primarily develops strength, endurance, and ease and skill of movement; and rough-and-tumble play, which adds a social component to play. Both of these types of physically active play involve gross motor movements (Pellegrini & Smith,

1998). Preschoolers' movement patterns vary considerably, although they tend to be comprised of short bursts of activity and velocity due to a lack of attention span and motor development (Oliver et al., 2007; Tucker, 2008).

Prevalence of Sedentary Behaviours Among Preschoolers

Several researchers have indicated that preschoolers are spending increasingly longer periods of time in sedentary behaviours. Sallis and colleagues found that preschoolers were spending 58% of their free-play time in sedentary pursuits (Sallis, Patterson, McKenzie, & Nader, 1988). Cardon and De Bourdeaudhuij (2008) indicated even higher rates, with preschoolers (ages 4-5; $n = 76$) spending 85% (9.6 hours) of their day in sedentary activity. From the Canadian Health Measures Survey, Colley and colleagues (2013) also found that preschoolers were spending approximately half of their waking hours in sedentary activity, with around 2 hours of this time spent engaged in screen viewing activities (e.g., watching television or playing on the computer). Similarly, Dolinsky and colleagues (2011) found that preschoolers from the United States (2-5 years; $n = 337$) spent approximately 6.1 hours in sedentary activity. Carson and Janssen (2012) found that 13.6 % of Canadian preschoolers (aged <5 years; $n = 746$) engaged in more than 2 hrs/day of screen viewing and 43.5% engaged in greater than 1 hr/day. These rates are disconcerting given that time spent participating in sedentary behaviours has been found to track more consistently over time than rates of physical activity (Janz, Burns, & Levy, 2005; Taylor et al., 2009).

Maternal Influence on Preschoolers' Active and Sedentary Behaviours

A multitude of factors have been identified as influencing the activity levels and patterns of preschoolers, including demographic and biological (Hinkley, Crawford,

Salmon, Okely, & Hesketh, 2008; Hinkley et al., 2012), psychological (Hinkley et al., 2012), socio-cultural and environmental (Hinkley et al., 2008, 2012; van Sluijs et al., 2013). Among the socio-cultural factors, parental influence is a particularly important correlate of preschoolers' active behaviours given that this social variable may be one of the most amenable to change (Sallis et al., 1988). Specifically during the preschool years, parents (or other adult caregivers) have been recognized as having a significant influence on their children's physical activity behaviours (Alderman, Benham-Deal, & Jenkins, 2010; Loprinzi, Schary, Beets, Leary, & Cardinal, 2013; Loprinzi & Trost, 2010). A recent systematic review by Mitchell and colleagues (2012), addressing parental influence among preschool-aged children (2-7 years) found that parents have the ability to influence their children's activity behaviours via social learning (e.g., role modeling), parental behaviours (e.g., encouragement and support), and parental perceptions (e.g., value placed on the importance of physical activity; Mitchell et al., 2012). Hendrie, Coveny, and Cox (2011) found that parents' involvement in physical activity with their children (5-11 years), modeling of active behaviours, and support of being physically active accounted for 37.6% of the variance in the activity levels within the family environment (Hendrie et al., 2011). This is particularly important given that Sallis and colleagues (1988) suggested that there is the potential for the effects of parental role modeling of active behaviours to extend beyond the home environment in to other free-play settings (e.g., childcare; Sallis et al., 1988). However, although parents are aware of the importance of modeling healthy behaviours for their young children, barriers such as time constraints and perceived safety concerns in their neighbourhood may prevent them

from encouraging their children to be physically active (Pocock, Trivedi, Wills, Bunn, Magnusson, 2010).

Of particular importance are the activity levels among preschool-aged children and their mothers. Mothers with preschool children perceived that *parental role* was the strongest influence predicting their child's opportunities for and participation in physical activity (Hinkley, Salmon, Okely, Crawford, & Hesketh, 2011). However, current evidence indicates that mothers with young children are less active compared to women without young children (Adamo, Langlois, Brett, & Colley, 2012; Bellows-Riecken & Rhodes, 2008; Mackay, Schofield, & Oliver, 2011) and many are not accumulating the adult recommendation of 150 minutes of activity per week (Adamo et al., 2012; Brown, Brown, Miller, & Hansen, 2001; Mackay et al., 2011). Women with young children also tend to be less active than they were prior to having children (Mackay et al., 2011). Moreover, a review of physical activity in parenthood highlighted that declines in physical activity during this time are more apparent among mothers than fathers (Bellows-Riecken & Rhodes, 2008).

This could be a result of mothers spending more time caring for children than fathers (Craig, 2006). In fact, mothers of dual parent families spend approximately twice as long caring for children as fathers do (Craig, 2006). Although fathers' activity levels have been found to be influential on their preschoolers' physical activity behaviours (Cantell et al., 2012; Moore et al., 1991; Taylor et al., 2009), the more apparent decline in physical activity among mothers with young children may have a unique impact on that of their children. Given that mothers are often the primary organizers of a family's opportunities to be active (Bevan & Reilly, 2011; Shannon, 2014), and mothers' activity

levels may directly impact preschoolers' physical activity behaviours (Hesketh, 2014; Moore et al., 1991), further exploration into maternal and preschooler physical activity is warranted.

Research in the area of a parent's impact on young children's physical activity and sedentary behaviour is still developing and current results are inconsistent due to various definitions of parental influence (Mitchell et al., 2012; Skouteris et al., 2011). Furthermore, the term 'parental influence' can encompass many constructs (e.g., parental support, encouragement, parents own physical activity levels, etc.), and as a result has been measured in various ways (Biddle, Atkin, Cavill, & Foster, 2011). Given the multidimensional nature of a parent's influence, there is a need to utilize more comprehensive measures to assess the relationship between parent and child activity behaviours (Sleddens et al., 2012). Focusing on the maternal role and preschoolers' activity levels is necessary as health-related behaviours, including physical activity, are developed at an early age (Hills, King, & Armstrong, 2007), and young children are largely under the control of their parents (Alderman et al., 2010; Irwin, He, Bouck, Tucker, & Pollett, 2005; Tucker, Irwin, He, Bouck, & Pollett, 2006). While many preschool-aged children are enrolled in some form of childcare (Goldfield et al., 2012), it has been suggested that preschoolers have reduced activity levels during after-childcare hours, which indicates that there may be factors in the home environment that hinder the amount of time preschoolers are active (Benham-Deal, 2005; Cardon & De Bourdeaudhuij, 2008; Verbestel et al., 2011). This may be attributed to the commonly-held belief of both parents and caregivers that preschool children are naturally active and, as a result do not need further encouragement to participate in physical activity or active

play (e.g., running, dancing, skipping; De Craemer et al., 2013; Hesketh, Hinkley, & Campbell, 2012). In fact, a study by Hesketh et al., (2013) found that approximately 90% of mothers of inactive 4-year-olds ($n = 438$) believed their child was sufficiently active. There appears to be a disconnect between mothers' awareness of how active their children are (not) and their actual level of activity (Berry et al., 2014). The misperception that young children are innately active could impact mothers' likeliness to encourage and support increased involvement in physical activities and reduced time spent in sedentary pursuits that are necessary for children's optimal health and development. Therefore, exploring the potential role mothers have on preschoolers' activity levels, via acting as "gatekeepers" for opportunities and resources to be active, is warranted (Welk, Wood, & Morss, 2003, p. 19).

For the purposes of this study, maternal influence will be operationally defined to encompass: role modeling (i.e., being physically active or sedentary themselves), maternal support (i.e., encouragement, co-participation in physical activity with their child, facilitation of opportunities to be active [e.g., transportation], watching their child be active, and telling their child physical activity is good for their health); and maternal attitudes towards being active (i.e., a mother's own enjoyment physical activity). Each factor will be discussed below.

Role modeling. According to Gustafson and Rhodes (2006), "parents are one of the most important socializing agents for children, and their physical activity behaviours are generally considered to be one of the strongest determinants of a child's activity patterns" (p. 80). Modeling, a concept stemming from Bandura's social learning theory, stipulates that through watching a caregiver's behaviours, children will internalize and

then display similar behaviours and/or habits (Bandura, 1977). Following the observation of these behaviours, the child will usually imitate the action even if the model is no longer present (Bandura, 1977). Based on Bandura's theory, more active mothers would likely have more active children, and more sedentary mothers would impart these behaviours on to their children. Mothers who participate in physical activity, and believe it to be important in the maintenance of a healthy lifestyle, may be more likely to promote and support their children to adopt these attitudes and behaviours (Hinkley et al., 2011). O'Dwyer, Fairclough, Knowles, and Stratton (2012) found that preschool children with more active parents were more likely to be active themselves and spend less time in sedentary pursuits. Thus, by highlighting the importance of being active during early childhood, the researchers argued that parents were more inclined to encourage participation in physical activity while minimizing sedentary behaviours (O'Dwyer, Fairclough, Knowles, & Stratton, 2012).

There are a limited number of studies that specifically examine the unique relationship between mothers' physical activity and that of their preschool-aged children (Hesketh et al., 2014b; van Sluijs et al., 2013). Other studies that examined the accelerometer-derived physical activity levels of both parents (but assessing mothers and fathers activity levels separately) have also indicated a positive relationship between mothers' and preschoolers' activity levels (Cantell, Crawford, & Dewey, 2012; Moore et al., 1991; Ruiz, Gesell, Buchowski, Lambert, & Barkin, 2011). Similarly, studies using self-reported parental (mother and father) physical activity levels have indicated mother-child activity levels are related (Spurrier, Magarey, Golley, Curnow, & Sawyer, 2008; Zecevic, Tremblay, Lovsin, & Michel, 2010). Additionally, although Oliver and

colleagues (2010) examined mother and father physical activity rates together as an overall parental physical activity rate, the sample was predominately made up of mothers (75.6%). Researchers in this study also found a positive association between preschoolers and parents' activity levels (Oliver, Schofield, & Schluter, 2010).

Demonstrably, the relationship between maternal activity levels and their preschoolers' activity was evident within the Framingham Study (Moore et al., 1991). Moore and colleagues (1991) monitored the physical activity levels of both parents (mothers, $n = 99$; fathers, $n = 92$) and children (aged 4-7 years old; $n = 100$) using Caltrac accelerometers. The findings highlighted that with one active parent, benefits to children's activity levels were found. Children of active mothers were 2 times more likely to be active compared to children with inactive mothers. Other studies have also found mothers' physical activity levels to be influential. Ruiz and colleagues (2011) found that preschoolers' (ages 3-5; $n = 80$) sedentary, mild, and moderate physical activity levels had a strong positive association with their Hispanic parents' activity levels (within this study mothers comprised 97.5% of the sample). Using a population-based sample in the United Kingdom, Hesketh et al. (2014b) found that there was a direct positive relationship between the activity levels of 4-year-old children ($n = 554$) and that of their mothers. A stronger relationship between mother-child MVPA on weekdays and mother-child light physical activity (LPA) on weekends was found (Hesketh et al., 2014b). van Sluijs et al. (2013) also found a relationship between preschoolers' activity levels measured by accelerometry and mothers' self-reported physical activity. In this study, preschoolers' LPA was positively associated with mothers' activity levels. Similarly, Spurrier et al. (2008) found that mothers' participation in greater physical

activity resulted in more outdoor playtime for children (a proxy measure for children's physical activity).

Conversely, a recent meta-analysis (involving children 2-18 years of age) found a weak association between parental activity levels and children and adolescents' physical activity. While the association was weak, it might have been moderated by the sample's age; meaning, there may have been a greater effect of parents' physical activity levels on young children than on older children or adolescents (Pugliese & Tinsley, 2007).

Alderman and colleagues' findings also support the notion that the relationship is stronger between parents' and children's physical activity levels during the preschool years (Alderman et al., 2010). Furthermore, mothers may have an even greater impact on their young children's activity as they are more likely to stay home during these years than fathers (Spurrier et al., 2008). However, some researchers have not found a relationship between mother-child activity levels (Dolinsky et al., 2011; Klohe-Lehman et al., 2007; Taylor et al., 2009).

Fewer studies have been conducted that examined the relationship between preschooler and mother sedentary behaviours; and results have been mixed. Xu and Wen (2012) examined the screen time and physical activity levels of mothers ($n = 242$) and their toddler-aged children (2 years). They found that a mother's screen viewing time was significantly associated with the child's screen time (Xu & Wen, 2012). Ruiz and colleagues (2011) indicated that preschoolers' sedentary time was strongly associated with that of their parents (97.5% mothers) and the parents participating in their study spent more time in sedentary activity and were less physically active than their preschool-aged children. This aligns with research conducted by Jago and colleagues that suggested

slightly older children (ages 5 and 6) spent more time watching TV on weekdays and weekends when parents spent more than two hours watching TV (Jago et al., 2014). In another study involving 3-5 year old children by Jago et al. (2013), the researchers found that when parents (91.3% mothers) watched more than 2 hours of TV per day, children were 5 times more likely to also watch more than 2 hours of TV daily (Jago et al., 2013).

While role modeling appears promising as an important mechanism for supporting healthy activity behaviours among preschoolers, there is a lack of research comprehensively examining mothers' influence and Canadian data objectively exploring this relationship is lacking. As such, an exploration of the relationship among Canadian preschoolers and their mothers is warranted.

Maternal support. According to Beets, Cardinal, and Alderman (2010), social support can be described as, “interactions between a parent and his or her children in the context of intentionally participating in, prompting, discussing, and/or providing activity-related opportunities” (p. 624). It has been indicated in recent studies that parents who were aware of the importance of physical activity were more likely to facilitate activity through providing support (Dowda et al., 2011; Loprinzi et al., 2013; Vaughn, Hales, & Ward, 2013) or by monitoring their child's activity (Loprinzi et al., 2013). Parental support has been positively associated with physical activity of children under the age of 18 years (Gustafson & Rhodes, 2006; Pugliese & Tinsley, 2007; Van Der Horst, Paw, Twisk, & Van Mechelen, 2007; Yao & Rhodes, 2015). Moreover, parental support of physical activity is considered a predictor of greater levels of physical activity among preschool-aged children (Loprinzi & Trost, 2010; Schary, Cardinal, & Loprinzi, 2012). In fact, in a study involving 102 preschoolers (respondents 96% mothers), Zecevic et al.

(2010) found that when children received greater parental support, they were 6.3 times more likely to be highly active than inactive. As previously defined, parental support includes encouragement to be physically active, involvement (e.g., co-participation in activity), facilitation through instrumental support (e.g., transportation to places to be active, paying for registration in sports), watching the child participate in physical activity, and providing information about physical activity. These are discussed in detail below.

Encouragement. Encouragement is often provided by parents in the form of motivational prompts and recommendations to be physically active (Beets et al., 2010). In a systematic review focusing on the influence of parental support on activity-related behaviours among children and adolescents under the age of 18, researchers found that encouragement was one of the most influential forms of intangible support (Beets et al., 2010). Yao and Rhodes (2015) recently conducted a meta-analysis and found that the only support behaviour to have a moderate effect size ($r = .34$) was the relationship between encouragement and physical activity among children and youth (ages 2.5-18). Interestingly, parental prompts and encouragement tend to be a stronger predictor of vigorous activity among children rather than light or moderate intensities (Klesges, Malott, Boschee, & Weber, 1986). A study using focusing groups (Tucker, van Zandvoort, Burke, & Irwin, 2011) indicated that parental encouragement was important to foster a healthy active lifestyle among preschoolers. Similarly, Dwyer, Higgs, Hardy and Baur (2008) found that parents were aware that modeling and encouragement of activity were important predictors of both physical and sedentary activity (Dwyer et al., 2008).

Maternal involvement. Both parental involvement in activity with their children and facilitation of opportunities to be active have been suggested as viable ways to increase preschoolers' participation in physical activity (Tucker et al., 2011). For preschoolers, unstructured play can be a valuable way to increase activity levels (Burdette & Whitaker, 2005) and affords parents the opportunity to become involved with their children's activity (Ginsburg, 2007). In a review of physical activity correlates among preschool children, parental involvement (or co-participation) was associated with more active preschoolers compared to children whose parents did not participate with them in physical activity (Hinkley et al., 2008). Hinkley and colleagues (2012) also indicated that more time was spent being physically active when the preschooler was active with their parent. However, a study using accelerometers to assess the physical activity levels of both preschoolers and parents found that only 20-30% of parents were involved in physical activity with their preschool children (Cantell et al., 2012). Lack of co-participation with their preschoolers could be a result of parents often facing barriers when it comes to joining in physical activity with their children (i.e., work demands, lack of time and energy; Dwyer, Needham, Simpson, & Shaver-Heeney, 2008; Hesketh et al., 2012).

Maternal facilitation via instrumental support. Instrumental behaviours (such as, transportation, paying for activity fees, purchasing sport/activity equipment) have been positively related to preschoolers' activity levels (Dowda et al., 2011; Klesges, Eck, Hanson, Haddock, & Klesges, 1990; Pugliese & Tinsley, 2007; Schary et al., 2012). Spurrier et al. (2008) also noted that within the home environment, outdoor play equipment and a large backyard were positively correlated with activity levels among

preschool children. However, if preschoolers are more inclined to participate in sedentary activity, parents might not invest as much in these sorts of activities (Spurrier et al., 2008). In addition, researchers have suggested that the number of visits to a location where preschoolers can actively play (e.g., parks, play gyms, etc.) resulted in higher levels of physical activity (Hinkley et al., 2012). By facilitating opportunities to be active, mothers may be able to increase their child's tendency to participate in physical activity.

Watching child participate in physical activity. In a review on parental support, Beets and colleagues suggested that the act of watching or supervising active play can also be supportive (Beets et al., 2010). Being present while the child participates in physical activity may be for supervision purposes or to watch the child for safety reasons (especially for young children; Beets et al., 2010). Schary and colleagues examined parental support of preschoolers' active behaviours and found that watching a child participate in physical activity was positively associated with preschoolers' activity levels (Schary et al., 2012). Thus, should parents be unable to participate in physical activity with their child, being present while the child is active may still be influential and support their active behaviours.

Providing information on physical activity. The provision of information on physical activity has been studied as a dimension of parental support in previous studies (Beets et al., 2010; Dowda et al., 2011; Schary et al., 2012; Zecevic et al., 2010). Beets and colleagues defined providing information as discussing the importance of being active and/or how to be active (Beets et al., 2010). Recently, Schary et al. (2012) examined the provision of information on physical activity among preschoolers and found it was positively related to their activity levels. This dimension of support is

commonly measured with other support variables as a composite score (e.g., Dowda et al., 2011; Trost et al., 2003; Zecevic et al., 2010); therefore, not a lot is known about its influence on preschoolers' physical activity or sedentary time.

Maternal enjoyment. Parental enjoyment of physical activity has also been indicated as an important component of preschoolers' activity levels (Zecevic et al., 2010). Positive emotional reactions while participating in physical activity can also be influential on an observer's behaviour (Bandura 1971). For example, based on Bandura's SLT (1971), if a child observed their mother enjoying being active, they would too be drawn to engage in similar activities. Bandura elaborates that "vicariously elicited emotions can become conditioned either to the modeled behavior or to environmental stimuli..." (1971, p. 26). In a qualitative study involving parents of preschoolers, Irwin and colleagues (2005) reported that parents were mindful that their own activity behaviours and preferences impacted that of their children (Irwin et al., 2005). Consequently, if parents displayed enjoyment of being physically active, children would be more inclined to enjoy similar activities (Irwin et al., 2005). The opposite can also be said, as mothers' lack of enjoyment can hinder their children's activity levels (Hinkley et al., 2011). Comparative results were found in a study by Dowda et al. (2011), which indicated that parental enjoyment of physical activity was significantly related to the support afforded to their children to be active. The provision of support was then also significantly associated with preschoolers' MVPA (Dowda et al., 2011). Unlike Dowda et al. (2011), Loprinzi and Trost (2010) did not find parental enjoyment of physical activity to be related to preschoolers' activity. Given the control parents have over their

preschoolers' actions (Carson & Janssen, 2012; Irwin et al., 2005), parents' own attitudes are likely to shape the behaviours of their children.

Study Rationale

Physical activity is a modifiable behaviour that has numerous physiological and psychological benefits (Timmons et al., 2007). Regardless of these positive health associations, many Canadian preschool-aged children are insufficiently active (i.e., spent less time in higher intensity activity) and are spending a significant amount of time in sedentary pursuits. With low MVPA and high sedentary time observed during the preschool years, interventions to increase the intensity of physical activity and decrease the hours being sedentary among the preschool population are necessary to help set the foundation for healthy active lifestyles (Goldfield et al., 2012). Parents have the potential to influence the activity levels of their young children (Mitchell et al., 2012; Zecevic et al., 2010); as this is a period in childhood when their behaviours are under less volitional control. Specifically, mothers tend to be the primary organizers of a family's opportunities to be active (Bevan & Reilly, 2011; Shannon, 2014) and therefore, may serve as important facilitators of chances to be physically active for their children. Furthermore, given that mothers of young children tend to have decreased levels of physical activity themselves, additional investigation into mothers' role modeling of active behaviours is warranted. A few studies have been undertaken to explore this relationship (most frequently focused on physical activity rather than sedentary activity), but many studies have explored only a few (inconsistently operationally defined) constructs of parental influence rather than taking a comprehensive approach to explore the many ways in which mothers impact their preschoolers' activity behaviours. To date,

one Canadian study has used an objective measure (i.e., accelerometers) on preschool-aged children and both mothers and fathers to determine associations between their physical activity levels (Cantell et al., 2012). The present study will build on Cantell et al.'s (2012) work by incorporating other aspects of parental influence (e.g., maternal support and maternal enjoyment of being active). The lack of Canadian evidence in this area has been highlighted in the Active Healthy Kids Canada Report Card, the latter suggested that more research is needed that focuses on parental influences and “their respective impact on the physical activity levels of children” (Active Healthy Kids Canada, 2013, p. 47). Thus, it is vital to determine the manner in which mothers can influence the sedentary and activity levels of children in this age group. Specifically, further investigation is needed that provides a more inclusive exploration of maternal influence and the impact on preschoolers’ objectively measured physical activity and sedentary time.

Study Purpose

The purpose of this study was to determine: 1) the relationship between mothers’ and preschoolers’ objectively measured physical activity and sedentary time (i.e., mothers’ influence via role modeling); and, 2) which maternal influence variables (i.e., maternal support through: encouragement, co-participation, facilitation via instrumental support, watching the child participate in physical activity, and providing information about physical activity; and mother’s enjoyment of being active) are associated with preschoolers’ activity and sedentary levels. This is the first Canadian study to undertake a comprehensive assessment of *maternal influence* on preschoolers’ physical activity and sedentary time.

Chapter 2: Methods

Study Design

This cross-sectional study explored mothers' influence(s) on preschoolers' physical activity and sedentary time. To achieve this, preschoolers and their mothers were invited to participate in this study. Ethics approval (Appendix A) was obtained through the University of Western Ontario's Research Ethics Board. A letter of information (Appendix B) and consent form for the preschooler and mother (Appendix C) were provided to all participants prior to the commencement of the study. Each mother was required to sign a consent form prior to participation and also asked to sign on behalf of their child. To acknowledge their participation, mothers received a \$10 gift certificate to a local grocery store as a token of appreciation, along with a letter of thanks (Appendix D) at the end of the data collection period.

Sample size. Using the A-Priori Sample Size Calculator for Multiple Regression (Soper, 2015), a sample size calculation was carried out to determine an adequate and appropriate sample size for this study. A minimum sample size (N) of 39 mother-child dyads was deemed sufficient to detect a medium effect ($r^2 = .35$) among four independent predictors with 80% power at an alpha level of .05.

Recruitment. Recruitment took place from August 2014 to February 2015. The study advertisement/poster (Appendix E) was distributed to locations around London, Ontario (and surrounding areas) that preschool-aged children and their mothers are known to frequent, including: grocery stores; fitness and yoga studios; toy stores; clothing outfitters; London Public Libraries; the University of Western Ontario; the Middlesex-London Health Unit; Ontario Early Years Centres; childcare centres;

Momstown (an online community of mothers); London Children's Museum; London Children's Connection; and, Childreach (an Early Childhood Development and Parent Centre). The advertisement of the study was in the form of print posters or an online format (such as a website or social media page). Additionally, participants were recruited via snowball sampling (e.g., emailing invitations to contacts recommended to the researchers as having a preschooler; Appendix F). Finally, preschoolers who have participated in previous (unrelated) studies and indicated their desire to participate in future research were contacted. Efforts were made to over sample to account for participant attrition due to wear time issues with accelerometers or device malfunction.

Participants

Inclusion criteria. Participants included both preschool-aged children and their mothers. To be included in this study: 1) the preschool child must have been between the ages of 2.5 and 5 years old at the time of data collection; 2) mothers must have been able to speak, understand, read, and write in English; 3) preschoolers and their mothers had to be willing to wear an accelerometer; and, 4) participants had to live in London, Ontario and surrounding areas. Participants were excluded if they did not fall within the age range, if they did not live in London and area, and/or if they did not receive parental consent.

Instruments and Tools

Actical accelerometers. To assess the amount and intensity of physical activity and sedentary time among participants (both preschoolers and their mothers), Actical™ (Minimeter, Bend, Oregon) accelerometers were worn on an adjustable elastic belt, around the participants' right hips for 7 consecutive days (i.e., 5 weekdays and 2

weekend days) during waking hours only. These small, lightweight, and waterproof motion sensors are considered valid and reliable measurements of preschoolers' (Bornstein, Beets, Byun, & McIver, 2011; Lubans et al., 2011; Pfeiffer, Mciver, Dowda, Almeida, & Pate, 2006) and adults' physical activity levels (Heil, 2006; Oliver et al., 2007). Moreover, because of preschoolers' specific movement patterns (i.e., sporadic with short bursts), Actical accelerometers are appropriate because of their capability to detect omnidirectional movement at shorter epoch lengths (Oliver et al., 2007). Current literature available on the activity levels of women with young children describes mothers' physical activity patterns to be more sporadic with less planned continuous bouts of MVPA (Mackay et al., 2011). Similar to preschoolers' movement patterns, utilizing a shorter epoch would help classify mothers' tendency to participate in intermittent physical activity as well. Consequently, physical activity levels were measured at an epoch length (or time interval) of 15-seconds, to frequently capture activity-related data. These accelerometers gather information on the amount of time spent being active at various intensity levels. Actical procedures and epoch lengths (15-seconds) were kept the same for both mother and child to be consistent in the data treatment (similar to Oliver et al., 2010).

Since the mother was responsible for the fitting and removal of the accelerometer each day, it was necessary to ensure she was well informed of the procedures and felt comfortable completing the task for the entire week. The researcher provided the mother with detailed instructions and training on how to wear the accelerometer and methods to fit and remove the device. Upon initiation of the study, mothers were informed to wear the accelerometer on the right hip, how to fill out the wear time log sheet and to press the

button on the Actical to indicate the times the device was put on and taken off.

Additionally mothers were asked to wear the device during waking hours only; and to remove the device for any water activities (e.g., bathing or swimming) as the belts are only water resistant (not water proof). Mothers were provided a wear log (Appendix G) to record the on and off times of the accelerometers for both themselves and their child(ren) and to indicate any time the belt was taken off throughout the day and for what reason (e.g., during naps or water activities).

Maternal Influence Questionnaire. At the initial meeting with mothers, an adapted version of the Environmental Determinants of Physical Activity in Preschool Children - Parent Survey, developed by Dowda and colleagues (2011), was provided (Appendix H). This questionnaire examined constructs related to modeling, mothers' supportive behaviours and attitudes towards being active. It was deemed a good fit for this study as the questions aligned with our study purpose. The tool was used to examine maternal support (5 items, Q-33 a-e) and mothers' own enjoyment of physical activity (1 item, Q-35). Several variables within this study have been evaluated previously and found to be reliable. The parental support variables (Q-33 a-e) were tested for reliability in both preschoolers (Schary et al., 2012; Zecevic et al., 2010) and older school-aged children (Sallis, Taylor, Dowda, Freedson, & Pate, 2002; Trost et al., 2003). The internal consistency, measured by Cronbach's alpha, was 0.75 in Zecevic et al.'s study and 0.76 when measured by Schary and colleagues (Schary et al., 2012; Zecevic et al., 2010). This finding was similar to that obtained by both Sallis et al. and Trost et al. ($\alpha = .78$) when measured with older children (Sallis et al., 2002). The 1-week test-retest reliability for this measure was $R = 0.81$ (Trost et al., 2003). Additionally, parental enjoyment of

physical activity (Q-35b) was evaluated using test-retest reliability in a study with youth (Trost et al., 2003) and again produced an adequate score, $R = 0.76$. For the purposes of this study, the questionnaire was adapted to focus primarily on mothers, as well as to include two additional evidence-based questions focused on the constructs being investigated (i.e., questions pertaining to preschoolers' and mothers' co-participation in sedentary behaviours and a child seeing/hearing mother talk about being active; Q-25; Q-35c, respectively). Furthermore, questions that were out of the scope of the current study (e.g., those related to the preschooler's birth, hospitalization, siblings, parents' perceptions of their own weight status, type of residence, and preschoolers' athletic coordination) were removed. Finally the response options were modified to reflect the Canadian system (e.g., university versus college, measurement units etc.). Demographic information pertaining to the preschoolers and their mothers were also asked in this questionnaire, this included: participants' (preschoolers' and mothers') age, sex, weight, household income, family status, childcare arrangement, and ethnic background. Demographics were gathered to determine the characteristics of the sample population.

The accelerometer log, accelerometer device, and survey were collected upon return to the participant's home at the end of the data collection week.

Data Analysis

All statistical analyses were completed using SPSS (version 22). Demographic information was measured using descriptive statistics. Accelerometer data was downloaded using Actical-specific software and quality criteria were applied using the *Kinesoft* program. Preschoolers' accelerometer data were analyzed according to preschooler-specific cut-points validated by Pfeiffer and colleagues (2006) and Wong and

colleagues (2011): sedentary activity, ($<50 \text{ counts} \times 15 \text{ s}^{-1}$), light activity ($\geq 50 \leq 714 \text{ counts} \cdot 15 \text{ s}^{-1} \cdot \text{epoch}$), moderate activity ($\geq 715 \leq 1410 \text{ counts} \cdot 15 \text{ s}^{-1} \cdot \text{epoch}$), and vigorous activity ($\geq 1411 \text{ counts} \cdot 15 \text{ s}^{-1} \cdot \text{epoch}$).

Mothers' activity levels were analyzed with Actical specific cut-points established by Colley et al. (2011) for adults. Because these cut-points are for a 60-second epoch, for the current analysis, we divided the cut-points by four to approximate 15-second intervals: sedentary activity ($<25 \text{ counts} \cdot 15 \text{ s}^{-1} \cdot \text{epoch}$), light activity ($\geq 25 < 383.75 \text{ counts} \cdot 15 \text{ s}^{-1} \cdot \text{epoch}$), moderate activity ($\geq 383.75 \text{ counts} < 990.5 \text{ counts} \cdot 15 \text{ s}^{-1} \cdot \text{epoch}$), and vigorous activity ($\geq 990.5 \text{ counts} \cdot 15 \text{ s}^{-1} \cdot \text{epoch}$).

KineSoft software version 3.3.62 (Kinesoft, Saskatchewan, Canada; a custom software program) was used to clean the Actical data and apply the appropriate number of days and hours of data collection necessary for inclusion in this analysis. Based on previous literature, a valid day was defined as ≥ 6 hour per day of wear for preschoolers (Colley et al., 2013; Pfeiffer et al., 2009) and ≥ 8 hours per day for mothers for at least 4 days (inclusive of 1 weekend day; Cliff, Reilly, & Okely, 2009; Colley et al., 2013). Non-wear time was classified as 60 consecutive minutes of zero activity (Dowda et al., 2011; Pfeiffer et al., 2009; Troiano et al., 2008). The data derived from the accelerometers for both preschoolers and mothers was summed, divided by wear time and reflected in mins/hr to determine time spent in various intensity levels and to account for varying accelerometer wear time adherence.

Four separate direct entry linear regression models were conducted to explore maternal influence on preschoolers' activity levels (i.e., sedentary, LPA, MVPA, and TPA). In line with Zecevic et al's (2010) practice, a composite score for maternal support

was determined for each participant by summing the scores from question 33 (a-e), and then a mean score was calculated across the non-missing values. Subsequently, the composite score for maternal support (encompassing Q33 [a-e]) and mothers' enjoyment of sports and exercise item (question 35-b) were entered into the regression models. Also included in the regression models were mothers' BMI (Sallis et al., 1988; calculated using the self-reported heights and weights from the questionnaire), and mothers' activity levels (i.e., sedentary, LPA, MVPA, and TPA; role modeling). In total, seven variables were entered into each of the regression models and run against preschoolers' sedentary, LPA, MVPA, and TPA levels to determine which maternal influence characteristics were predictive of preschoolers' activity levels.

Group comparisons were run for sex to see if differences existed. Four independent sample *t*-tests were conducted to determine if a distinction was present in young children's sedentary, LPA, MVPA, TPA (mins/hr) between sexes. A Bonferonni correction was applied to control for multiple comparison bias and to maintain an experiment-wise alpha of .05; as a result, all effects were reported at a level of significance of .0125.

Chapter 3: Results

Participant Demographics

In total, 39 mother-child dyads provided consent to participate in the study. Of these dyads, eight mothers had two preschool-aged children who participated. Consequently, the total number of preschool participants was 39 (mean age = 46.61 months; $SD = 11.75$; 18 males) and the number of mothers was 31. Data for four preschoolers and six mothers were not included in the analysis as they did not have sufficient wear time (i.e., ≥ 6 hrs/day for preschoolers; ≥ 8 hrs/day for mothers) and/or valid number of days (i.e., 4 days, inclusive of 1 weekend day). Any preschooler or mother who was no longer a part of a dyad was also not included in the analysis. Subsequently, the final sample was 30 dyads ($n = 30$ preschoolers; $n = 24$ mothers). See Table 1 and Table 2 for complete participant demographic information.

Preschoolers' and Mothers' Physical Activity and Sedentary Levels

Preschoolers' and mothers' accelerometer wear time varied for each day of data collection. Preschoolers' wear time ranged from 445.30 to 756.68 mins/day ($M = 620.91$, $SD = 79.52$), while mothers' wear time ranged from 579.25 to 958.90 mins/day ($M = 725.61$, $SD = 74.21$). Preschoolers' average valid days were 6.47 ($SD = .78$) and mothers' 6.54 ($SD = .83$). Table 3 presents the means and standard deviations for time spent in sedentary, light, moderate-vigorous, and total physical activity for both preschoolers and mothers. Comparisons of physical activity intensities and sedentary time between sexes revealed no significant differences (sedentary [$p = .569$]; LPA [$p = .576$]; MVPA [$p = .630$]; TPA [$p = .569$]).

Table 1*Preschooler and Family Demographic Variables (N = 39)*

	<i>N</i>	<i>%</i>
Sex		
Male	18	46.2
Female	21	53.8
Childcare arrangement		
Home childcare	8	20.5
Centre childcare	6	15.4
Preschool	1	2.6
With parent	7	17.9
School	13	33.3
Childcare in more than one setting	4	10.3
Preschooler's childcare status		
Full-time childcare	32	82.1
Part-time childcare	3	7.7
Child's racial or ethnic background		
Caucasian	29	74.4
Arabic	1	2.6
Asian	3	7.7
Other	6	15.4

Note: Some values shown in the table may not add up to 100% or *N* = 39 as some individuals chose not to answer certain questions.

Table 2*Mother's Demographic Information (N = 31)*

	<i>N</i>	<i>%</i>
Age group of mother		
25-34	13	41.9
35-44	18	58.1
Mother's racial or ethnic background		
Caucasian	26	83.9
Arabic	1	3.2
Asian	2	6.5
Other	2	6.5
Family arrangement		
Two-parent household	26	83.9
Single-parent household	5	16.1
Highest level of education completed for mother		
College	6	19.4
University	14	45.2
Graduate school	11	35.5
Mother's employment status		
Homemaker, raising children, caring for others	5	16.1
Employed full-time	11	35.5
Employed part-time	8	25.8
Disabled, unable to work	1	3.2
Other	6	19.4

Household income

Less than \$20,000	1	3.2
\$20,000 - \$39,999	3	9.7
\$40,000 - \$59,999	4	12.9
\$60,000 - \$79,999	5	16.1
\$80,000 - \$99,999	3	9.7
\$100,000 - \$119,999	4	12.9
More than \$120,000	9	29.0
Prefer not to answer	2	6.5

Note: Some values shown in the table may not add up to 100% or $N = 31$ as some individuals chose not to answer certain questions.

Table 3

Summary of Preschoolers and Mothers' Physical Activity Intensities and Sedentary Time (mins/hr)

	Preschoolers	Mothers
	<i>M (SD)</i>	<i>M (SD)</i>
	<i>n</i> = 30	<i>n</i> = 24
Intensity		
Sedentary	45.63 (7.06)	43.59 (3.66)
LPA	13.15 (6.29)	14.01 (3.20)
MVPA	1.22 (1.06)	2.41 (1.29)
TPA (LPA and MVPA)	14.37 (7.06)	16.41 (3.66)

Note: LPA = light physical activity; MVPA = moderate-to-vigorous physical activity;
TPA= total physical activity

Maternal Influence and Preschoolers' Minutes of Sedentary Time

The first regression analysis was completed to determine the relationship between maternal support, mothers' enjoyment of sports/exercise, mothers' BMI, and mothers' role modeling (via their sedentary time, LPA, MVPA, and TPA) and preschoolers' minutes of *sedentary* time (outcome variable). The regression model accounted for 36.4% of the variation in preschoolers' sedentary time (adjusted $R^2 = 0.364$) and was statistically significant $F(5,24) = 4.319, p = .006$. Looking at the unique contribution of each variable within this model, maternal support ($p = .004$) and mothers' enjoyment of sports/exercise ($p = .039$) were significant. Maternal support and mothers' enjoyment of sports/exercise were inversely related to preschoolers' sedentary time, accounting for 54.7% and 40.8% of the variation, respectively. Sedentary time and LPA were eliminated from the model due to multicollinearity. The coefficients, p -values, and partial correlations for mothers' influence on preschooler's sedentary time are presented in Table 4.

Maternal Influence and Preschoolers' Minutes of LPA

The direct entry linear regression model accounted for 35.5% of the variation in preschoolers' LPA (adjusted $R^2 = 0.355$) and was statistically significant $F(5,24) = 4.196, p = .007$. Further examination of the unique contribution of each variable found maternal support ($p = .005$) and mothers' enjoyment of sports/exercise ($p = .035$) to be significant. Maternal support and mothers' enjoyment of sports/exercise were positively associated with preschoolers' LPA and accounted for 53.2% and 41.6% of the variation, respectively. Mothers' sedentary time and LPA were eliminated from the model due to multicollinearity. The coefficients, p -values, and partial correlations for mothers' influence on preschoolers' LPA are presented in Table 5.

Table 4

Summary of Coefficients, Confidence Intervals, t-values, p-values and Partial Correlations for Preschoolers' Sedentary Time

Maternal Influence Variables	B	95% CI		<i>t</i>	<i>p</i>	Partial Correlations
		[lower bound, upper bound]				
Overall maternal support	-5.121	-8.420, -1.822		-3.204	.004*	-.547
Mothers' enjoyment of sports or exercise	-3.111	-6.045, -.177		-2.189	.039*	-.408
Mothers' BMI	.539	-.059, 1.137		1.859	.075	.355
Mothers' MVPA	-.052	-2.005, 1.902		-.055	.957	-.011
Mothers' TPA	.600	-.103, 1.303		1.762	.091	.338

Note. Model accounts for 36.4% of the variability in sedentary time; $p < .05$; CI = confidence interval; * = significant variable; BMI = Body Mass Index; MVPA = moderate-to-vigorous physical activity; TPA = total physical activity.

Table 5

Summary of Coefficients, Confidence Intervals, t-values, p-values and Partial Correlations for Preschoolers' LPA

Maternal Influence Variables	B	95% CI		<i>t</i>	<i>p</i>	Partial Correlations
		[lower bound, upper bound]				
Overall maternal support	4.409	1.453, 7.364		3.079	.005*	.532
Mothers' enjoyment of sports or exercise	2.853	.225, 5.481		2.241	.035*	.416
Mothers' BMI	-.478	-1.014, .058		-1.842	.078	-.352
Mothers' rate of MVPA	-.166	-1.916, 1.584		-.195	.847	-.040
Mothers' rate of TPA	-.533	-1.162, .097		-1.747	.093	-.336

Note. Model accounts for 35.5% of the variability in LPA; $p < .05$; CI = confidence interval; * = significant variable; LPA = light physical activity; BMI = Body Mass Index; MVPA = moderate-to- vigorous physical activity; TPA = total physical activity.

Maternal Influence and Preschoolers' Minutes of MVPA

The direct entry regression model for preschoolers' *MVPA* accounted for 24.5% of the variation (adjusted $R^2 = 0.245$) and was statistically significant $F(5,24) = 2.879, p = .036$. When looking at the unique contribution of each variable within this model, the only significant predictor of preschoolers' *MVPA* was maternal support ($p = .012$), which accounted for 48.5% of the variation in preschoolers' *MVPA*. Sedentary time and LPA were eliminated from the model due to multicollinearity. The coefficients, p -values, and partial correlations for mothers' influence on preschoolers' *MVPA* are presented in Table 6.

Maternal Influence and Preschoolers' Minutes of TPA

This regression model accounted for 36.4% of the variation in preschoolers' *TPA* (adjusted $R^2 = 0.364$) and was statistically significant $F(5,24) = 4.319, p = .006$. Upon examining the model further, maternal support ($p = .004$) and mothers' enjoyment of sports/exercise ($p = .039$) were found to be significant. Maternal support accounted for 54.7% of the variation in preschoolers' *TPA* and mothers' enjoyment accounted for 40.8%. Sedentary time and LPA were eliminated from the model due to multicollinearity. The coefficients, p -values, and partial correlations for mothers' influence on preschooler's *TPA* are presented in Table 7.

Table 6

Summary of Coefficients, Confidence Intervals, t-values, p-values and Partial Correlations for Preschoolers' MVPA

Maternal Influence Variables	B	95% CI		<i>t</i>	<i>p</i>	Partial Correlations
		[lower bound,	upper bound]			
Overall maternal support	.712	.171	1.252	2.719	.012*	.485
Mothers' enjoyment of sports or exercise	.258	-.223	.739	1.108	.279	.221
Mothers' BMI	-.061	-.159	.038	-1.274	.215	-.252
Mothers' MVPA	.217	-.103	.537	1.402	.174	.275
Mothers' TPA	-.067	-.182	.048	-1.204	.240	-.239

Note. Model accounts for 24.5% of the variability in MVPA time; $p < .05$; CI = confidence interval; * = significant variable; BMI = Body Mass Index; MVPA = moderate-to- vigorous physical activity; TPA = total physical activity.

Table 7

Summary of Coefficients, Confidence Intervals, t-values, p-values and Partial Correlations for Preschoolers' TPA

Maternal Influence Variables	B	95% CI		<i>t</i>	<i>p</i>	Partial Correlations
		[lower bound, upper bound]				
Overall maternal support	5.121	1.822, 8.420		3.204	.004*	.547
Mother's enjoyment of sports or exercise	3.111	.177, 6.045		2.189	.039*	.408
Mother's BMI	-.539	-1.137, .059		-1.859	.075	-.355
Mothers' MVPA	.052	-1.902, 2.005		.055	.957	.011
Mothers' TPA	-.600	-1.303, .103		-1.762	.091	-.338

Note. Model accounts for 36.4% of the variability in TPA; $p < .05$; CI = confidence interval; * = significant variable; BMI = Body Mass Index; MVPA = moderate-to-vigorous physical activity; TPA = total physical activity.

Chapter 4: Discussion

The purpose of this study was to explore mothers' influence on the activity levels of their preschool-aged children. Specifically, this research sought to examine: the relationship between mothers' and preschoolers' objectively-measured physical activity (i.e., LPA, MVPA, TPA) and sedentary time; and, maternal influence (i.e., maternal support as a composite score [including encouragement, co-participation, facilitation via instrumental support, watching the child participate in physical activity, and providing information about physical activity] and mothers' enjoyment of being active) on preschoolers' activity levels. Current research examining maternal physical activity using objective methods is limited and insufficiently examines maternal influence comprehensively. For example, Hesketh and colleagues' (2014b) work only explored the association between mother-preschooler activity levels and how demographic and temporal factors influenced this association. Similarly, Cantell et al. (2012) explored preschoolers' physical activity with that of both their mothers and fathers, but did not explore support or enjoyment items. Given the lack of research taking a comprehensive approach to measuring maternal influence with objectively measured mother and preschooler physical activity and sedentary time, this study attempted to make an important contribution to the literature by examining a multitude of factors that may be impactful on preschoolers' activity behaviours.

Several studies (only one conducted in Canada; Cantell et al., 2010) have used objective measures (i.e., accelerometers) and found that mothers' own participation in physical activity (Cantell et al, 2010; Hesketh et al., 2014b; Moore et al, 1991; Oliver et al., 2010) and sedentary time (Hesketh et al., 2014b; Ruiz et al., 2011) is related to their

preschool children's level of activity. This suggests that mothers are role models for their children, and by engaging in physical activity themselves; their preschoolers are more likely to be active. The same can be said for sedentary time; the more sedentary time a mother participates in, the more likely her preschooler will as well. Using similar methods of measurement to examine mothers' influence via role modeling (Cantell et al., 2012; Moore et al., 1991; Oliver et al., 2010); mothers' own sedentary, LPA, MVPA, and TPA levels in this study were not found to be significantly related to their preschoolers' physical activity or sedentary time. This finding contradicts previous research that has demonstrated positive relationships between mother-child activity levels (Cantell et al., 2012; Hesketh et al., 2014b; Moore et al., 1991; Ruiz et al., 2011). For example, Moore and colleagues (1991) found that children with active mothers were 2 times more likely to be active compared to children with inactive mothers. Comparably, Hesketh et al. (2014b) found that for every minute of mothers' physical activity, children's MVPA participation increased by 10%. Given the negative trajectory of preschoolers' MVPA as they age (Colley et al., 2013), mothers' role modeling of physical activity may be a method to improve preschoolers' participation in MVPA into the later years.

Unfortunately, many mothers with young children tend to be less active than other women and men of equal age (Bellows-Riecken & Rhodes, 2008; Mackay et al., 2011). As there has been a previous indication of a positive association between mother-child activity levels (Cantell et al., 2012; Hesketh et al., 2014b; Moore et al., 1991), mothers who are less active unintentionally may discourage their children's activity levels at an early age. It is not clear why a similar relationship between mother-child physical activity levels was not observed in this study, but it is possible this is a consequence of the small

sample size used.

While mothers may influence their preschoolers' activity behaviours via role modeling (Hesketh et al., 2014; Moore et al., 1991), other maternal actions have been recognized as influencing preschoolers' activity patterns (e.g., through the provision of support to participate in physical activity; Spurrier et al., 2008). Specifically, maternal support; a composite score construct previously defined as encouragement, maternal involvement in physical activity with their child, the facilitation of opportunities to be active (instrumental support), watching their child participate in physical activity, and providing information about physical activity (Dowda et al., 2011; Sallis et al., 2002; Zecevic et al., 2010); was significantly related to preschoolers' physical activity levels and sedentary time. In fact, those preschoolers whose mothers accrued a higher maternal support score had preschoolers who were more active or participated in less sedentary time.

Previously, these dimensions of support were found to be related to preschoolers' activity levels when analyzed as a composite measure (Loprinzi & Trost, 2010; Schary et al., 2012; Zecevic et al., 2010). In this study, the composite score for maternal support was positively associated with preschoolers' LPA, MVPA, and TPA; accounting for approximately 48.8-54.9% of the variation in this group's activity levels. Furthermore, maternal support was inversely related to preschoolers' sedentary time and accounted for 54.9% of the variation of time spent in sedentary pursuits. Comparable to the results of our study, Rhodes and colleagues (2013) found that mothers valued the importance of physical activity for their children (ages 5-11); with 58% of Canadian mothers indicating physical activity was the first or second most important activity in which their child could

participate (Rhodes et al., 2013). Given the value mothers place on their children's active behaviours (Rhodes et al., 2013), it is therefore logical that maternal support to be active would be a significant predictor of their children's activity levels. In fact, Vaughn, Hale, and Ward (2013) found that parents who valued the importance of physical activity for their children were more likely to provide supportive practices for their preschoolers' physical activity.

Using the same parental support variables as in this study, Schary and colleagues (2012) found that parental support was positively associated with preschoolers' active play behaviours. More specifically, each of the five variables comprising overall parental support were positively related to active play behaviours when explored individually (Schary et al., 2012), with encouragement having the strongest association with preschoolers' physical activity. Similarly, using these same support dimensions as Schary et al. and the current study, Zecevic et al. (2010; whose sample of parents consisted of 96% mothers) found that when preschool-aged children received parental support for to be active, the children were 6.3 times more likely to be highly active than inactive. Although there are many mechanisms by which mothers are capable of influencing their preschoolers' physical activity and sedentary time, it is apparent that the provision of support to be active is an important approach to raising more active children.

Mothers' enjoyment of physical activity was also found to be significantly associated with their children's sedentary time, LPA, and TPA. When mothers enjoyed participating in sports and/or exercise, their preschoolers were more likely to participate in LPA and TPA. An inverse relationship was found for sedentary time, suggesting that a mother's enjoyment of sports or exercise decreased the amount of time their preschooler

spent in sedentary pursuits. Interestingly, mothers' enjoyment of sports or exercise was not found to predict preschoolers' MVPA levels. The lack of association found between mothers' enjoyment of sports/exercise and preschoolers' MVPA might suggest that mothers' enjoyment of activity is only impactful on lower intensity activity and minimizing sedentary time. As preschoolers in this study and others (Colley et al., 2013; Tucker et al., 2008; Vanderloo et al., 2014) have been found to engage in low levels of MVPA, mechanisms are needed to increase their activity intensities. As parents have noted that they believed their own enjoyment of physical activity would be passed on to their preschoolers and impact their tendency to be active (Irwin et al., 2005), more investigation into mothers' enjoyment of activity is warranted. This corresponds with the work by Hinkley et al. (2011), which emphasized the potential influence of mothers' lack of enjoyment and how this may hinder the activity behaviours of their children.

Our results support the findings of Zecevic and colleagues (2010), which highlighted that parents' enjoyment of physical activity was a significant predictor of preschoolers' daily activity. Similarly, although conducted with a sample of school-aged children (M age = 10.4), Brustad (1993) found that parental enjoyment of physical activity and a child's gender accounted for 32.2% of the variance in parents' encouragement of their child being active. This highlights that even as children age, positive parental role modeling of active behaviours may impact their children's activity behaviours and preferences. Clearly, maternal enjoyment of active behaviours plays an important role in the development of their children's tendencies to be active.

Mothers' provision of support to be active and their enjoyment of physical activity all appear influential on preschoolers' activity pursuits. Maternal support and

their own enjoyment of being active align with the social learning theory (Bandura, 1977) and the notion that mothers influence their children's healthy active behaviours. Given that behaviours are commonly learned through observation, any behaviour that is repeatedly performed will evoke the observer to reproduce or imitate a similar response (Bandura, 1971). Social learning theory emphasizes the importance of modeling and children's ability to learn behaviours through imitation. Although our study did not find a significant relationship between mother-child activity levels, children may also learn behaviours via mothers' enjoyment of being active. Specifically, a mother's positive emotion towards participating in physical activity can be influential on their child's behaviour (Bandura 1971), as the mothers' attitude towards being active may also be imparted onto their children.

Given that mothers tend to hold a more central role in the provision of care for their children than fathers (McBride & Mills, 1993), it is likely that mothers' physical activity behaviours and supportiveness would strongly influence that of their children. Parents have a distinct advantage in the development of their young children's preferences for physical activity given that they are largely in control of their behaviours (Irwin et al., 2005). In fact, mothers and their children (2-11 years) have been shown to demonstrate similar health habits (Greenberg, Ariza, & Binns, 2010). Therefore, encouragement and supportive mechanisms to increase physical activity in a manner that is feasible for mothers with young children, may in turn help increase the activity behaviours of the young children themselves.

Limitations and Future Directions

Although this is the first Canadian study to provide a comprehensive examination

of mothers' and preschoolers' levels of physical activity and sedentary time, several factors limit the scope and generalizability of this study. Firstly, a cross-sectional study design was utilized, which does not permit the inference of causation to be elicited from the findings. Secondly, most of the data collection was completed in the fall and early part of winter, and therefore, seasonality could have affected the participants' activity levels (Tucker & Gilliland, 2007). Thirdly, the accelerometer compliance for mothers and preschoolers was not ideal; mothers and their preschoolers who were excluded based on wear time either did not have a weekend day of activity data or did not accrue enough hrs/day of wear time. This limited the number of mother-child dyads available for analysis. As the number of mother-child pairs was small, this may have limited the statistical power necessary to determine significant relationships from both the accelerometer and questionnaire data. In addition to the sample being small, it was also relatively homogenous (i.e., mostly Caucasian, highly educated, higher income). Fourth, several constructs within the questionnaire were assessed by the use of a single question and may not have been an accurate representation of the construct being studied. Lastly, this study used a 15-second epoch for both preschoolers and mothers. While it has been indicated in the literature that a shorter epoch is necessary to capture the sporadic movements and short bouts of preschoolers' physical activity (Oliver et al., 2007), we were limited by the capability of the Actical accelerometers (this is the shortest epoch we could apply on the B-series model). Obeid and colleagues (2011) compared varying epoch lengths and found that the data derived using 3-second epochs resulted in less missed minutes of physical activity data. Specifically, they found that 2.9 minutes of MVPA were missed when a 15-second epoch length was applied compared to 3-seconds.

While this is a limitation of the current study, the practice of using a 15-second time sampling interval has been adopted by a number of researchers exploring physical activity among preschoolers (e.g., Dowda et al., 2011; Oliver et al., 2010; Vanderloo & Tucker, 2015).

Based on the present findings, it is apparent that the provision of maternal support is impactful on preschoolers' all physical activity intensities and sedentary time. To understand better the individual dimensions of support on preschoolers' active and sedentary behaviours, further research should be conducted among a larger sample size while employing objective measures of activity (Schary et al., 2012). Additionally, given that maternal enjoyment of sports and/or exercise did not influence this group's MVPA levels, additional focus is warranted to uncover ways of better supporting preschoolers' efforts to accumulate higher intensity activity. This is particularly important for preschoolers as they age given that the physical activity guidelines recommend 60 minutes of MVPA by age 5 (Tremblay et al., 2012a). Lastly, similar to other studies (Dolinsky et al. 2011; Taylor et al., 2009), we did not find an association between preschoolers' and mothers' activity levels. Interestingly, it has been found that fathers' activity levels are more strongly related to their young children's compared to mothers (Moore et al., 1995; Taylor et al., 2009). This could explain our non-significant findings. It is plausible that mothers influence their preschoolers in a more supportive nature rather than participating in physical activity themselves (role modeling). Thus, examining the role of fathers and mothers together, using objective measures and a comprehensive assessment of parental influence, would provide more understanding of this relationship.

Conclusion

Despite its limitations, this is the first Canadian study to objectively measure preschoolers' and their mothers' physical activity and sedentary levels, and acknowledges the important influence mothers have on their preschoolers' activity patterns. Maternal support was found to be significantly associated with their children's sedentary time, LPA, MVPA, and TPA. Mothers' enjoyment of being active was also significantly related to preschoolers' sedentary time, LPA, and TPA, but not MVPA. Both findings indicate the ability of mothers to serve as role models in the development of their young children's preferences to be active. Establishing habitual activity behaviours at a young age is crucial, as children tend to become less active as they age and participate in increased sedentary behaviours (Taylor et al., 2009). This study furthers the limited research examining maternal influence on preschoolers' activity and sedentary time in Canada. To ensure young children are meeting the national guidelines, it is imperative to examine a multitude of factors that may be influential, such as the role mothers play in modeling and supporting active behaviours. Given the Canadian physical activity guidelines differ from the United States, conducting such work in Canada is important. Finally, this study highlights the need for additional investigations using objective measures, such as accelerometers, in combination with relatively diverse and comprehensive assessments of maternal influences between a large sample of Canadian parents and their preschoolers.

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Appendix A - Ethics Approval



Research Ethics

Western University Health Science Research Ethics Board HSREB Delegated Initial Approval Notice

Principal Investigator: Dr. Patricia Tucker
Department & Institution: Health Sciences\Occupational Therapy, Western University

HSREB File Number: 105520
Study Title: Exploring the Influence of Mothers on Preschoolers' Physical Activity Levels
Sponsor:

HSREB Initial Approval Date: August 19, 2014
HSREB Expiry Date: April 30, 2015

Documents Approved and/or Received for Information:

Document Name	Comments	Version Date
Western University Protocol		
Other	Appendix H - Master List	2014/07/04
Recruitment Items	Appendix G - Recruitment Email	2014/07/05
Advertisement	Appendix F - Study Advertisement Poster	2014/07/04
Other	Appendix E - Letter of Thanks	2014/07/04
Other	Appendix D - Accelerometer Wear Time Log	2014/07/04
Caregiver Letter of Information & Consent		2014/08/01
Instruments	Appendix A - Questionnaire	2014/07/04

The Western University Health Science Research Ethics Board (HSREB) has reviewed and approved the above named study, as of the HSREB Initial Approval Date noted above.

HSREB approval for this study remains valid until the HSREB Expiry Date noted above, conditional to timely submission and acceptance of HSREB Continuing Ethics Review. If an Updated Approval Notice is required prior to the HSREB Expiry Date, the Principal Investigator is responsible for completing and submitting an HSREB Updated Approval Form in a timely fashion.

The Western University HSREB operates in compliance with the Tri-Council Policy Statement Ethical Conduct for Research Involving Humans (TCPS2), the International Conference on Harmonization of Technical Requirements for Registration of Pharmaceuticals for Human Use Guideline for Good Clinical Practice Practices (ICH E6 R1), the Ontario Personal Health Information Protection Act (PHIPA, 2004), Part 4 of the Natural Health Product Regulations, Health Canada Medical Device Regulations and Part C, Division 5, of the Food and Drug Regulations of Health Canada.

Members of the HSREB who are named as Investigators in research studies do not participate in discussions related to, nor vote on such studies when they are presented to the REB.

The HSREB is registered with the U.S. Department of Health & Human Services under the IRB registration number IRB 00000940.

[Redacted Signature]

Ethics Officer to Contact for Further Information

[Redacted Contact Information]

This is an official document. Please retain the original in your files.

Western University, Research, Support Services Bldg., Rm. 5150
London, ON, Canada N6A 3K7 [Redacted]

Appendix B – Letter of Information



Exploring the Influence of Parents on Preschoolers' Physical Activity Levels

Letter of Information for Parents/Guardians

Investigators:

Dr. Trish Tucker, School of Occupational Therapy, Western University
Alana Maltby, MSc student, Health and Rehabilitation Sciences, Western University

Invitation to participate:

This study aims to explore how parents' behaviours influence their preschoolers' physical activity levels. You and your child are being recruited because your child falls between the ages of 2.5 to 5 years of age.

Purpose of this letter:

The purpose of this letter is to provide you with the information needed to make an informed decision regarding both yours and your child's participation in the present study.

Background:

Currently, minimal research in Canada has been conducted examining the parental influence (e.g., support, encouragement, role modeling, co-participation, and facilitation of activity) on preschoolers' physical and sedentary activity levels. In addition, there have been few studies that have objectively measured both preschoolers' and their parents' activity levels. Consequently, researchers at Western University are undertaking this study to objectively measure the physical activity levels of Canadian preschool-aged children and their parents and to determine other influential factors that may relate to active behaviours. The information collected in this study will assist in identifying the activity levels of this particular cohort and their parents as a means of highlighting potential avenues for promoting and supporting healthy active behaviours among young Canadians.

What will happen during this study:

If you agree to participate, you and your child will wear an accelerometer (a small, motion sensor device) during all waking hours for 7 consecutive days. A pager-like device in size (please see picture below), the accelerometer would be worn on an adjustable elastic belt around the waist (over top of clothing) to collect information about the amount and intensity of yours and your preschoolers' movements. While wearing the accelerometer, you and your child would still be able to participate in all normal activities. If your child is enrolled in some form of early learning program (e.g., childcare, nursery school, etc.), we ask that you inform the childcare staff about the procedures of the study (i.e., your child is participating in a physical activity study where he/she is required to wear an accelerometer around his/her waist during all waking hours [including his/her time in childcare], etc.). In addition to this Letter of Information and consent form, you will also find the adapted Environmental Determinants of Physical Activity in Preschool Children Parent Survey. Please complete both of these forms and return them to the research team.



Inclusion and exclusion criteria:

In order for you and your preschooler to participate in this study, the following criteria are required: a) your child must be between the ages of 2.5 to 5 years old at the time of data collection, b) you must speak and read English, c) you [the parent] and your child must be willing to wear an accelerometer, and d) you must live in London, Ontario (and/or surrounding areas). You and your child will not be able to participate if: a) your child is not between the ages of 2.5 to 5 years old at the time of data collection, b) you do not speak and read English, c) you [the parent] or the child are not willing to wear an accelerometer, and d) you do not live in London, Ontario (and/or surrounding areas).

Alternatives and your right to withdraw from the study:

Yours and your child's participation in this study are voluntary. You may refuse to participate, refuse to answer any questions, or withdraw from the study at any time. You will also have the right to withdraw both your own and your child's data prior to the point of data entry, at which time, the data will not be removed. Your child also has the right to refuse participation on the day of data collection.

Possible benefits and risks to you for participating in the study:

There are no known risks for being in this study. You do not waive any of the legal rights you would otherwise have as a participant in a research study. The benefit to participating in this study might include the identification of a relationship between the physical activity levels of Canadian preschoolers and their parents, thus possibly supporting improved physical activity behaviours among this particular age group. There are no

personal benefits to you or your child participating in this study; however, to recognize your time, a small token of appreciation will be provided.

Confidentiality:

We will keep yours and your preschooler's identity, physical activity levels, and written records confidential and secure. No names will appear on any publications generated during the course of this study. If we find information we are required by law to disclose, we cannot guarantee confidentiality. All data obtained will be stored in secured computer files (password encrypted) and stored in locked filing cabinets at Western University. Only the research team will have access to these data. The data will be retained for 5 years after the results of the study have been published. After this period, all data will be destroyed (i.e., the computer data will be erased and all written/paper data will be shredded).

Costs:

There is no cost to you for participating in the study. To acknowledge your participation, a small token of appreciation will be provided.

Publication of the results:

When the results of the study are published, you/your child's name will not be used. If you would like to receive a copy of the overall results of the study, please tick the appropriate box on your child's consent form.

For further information on this study, you can contact the Principal Investigator, Dr. Trish Tucker.

* If you have any further questions regarding your rights as a study participant, please contact Western University's Office of Research Ethics.

This letter is for you to keep.

Appendix C – Consent Form



Exploring the Influence of Parents on Preschoolers' Physical Activity Levels

I have read the Letter of Information, have had the nature of the study explained to me, and I agree to participate. All questions have been answered to my satisfaction. Please check the boxes below to confirm your consent for both your own, and your preschoolers' participation in the current study.

- ☐ I consent to my child's participation
☐ I consent to my own participation

_____	_____	_____	_____
Date	Participant's Name (please print)	Parent/Guardian Name (please print)	Parent/Guardian Signature

_____	_____	_____
Date	Name of Researcher Obtaining Informed Consent (please print)	Signature

.....
 Do you wish to obtain a copy of the study results?

- ☐ Yes
☐ No

If YES, how would you prefer to receive the results? (Please provide necessary contact information)

- ☐ Email: _____
☐ Mail (post): _____

Would you like to be contacted to participate in future studies conducted by this research team?

- ☐ Yes (please provide contact information above)
☐ No

Appendix D – Letter of Thanks



Exploring the Influence of Parents on Preschoolers' Physical Activity Levels

Dear (insert participant's name):

On behalf of our research team, I would like to thank you for consenting to both yours and your child's participation in this study. The information collected will assist with the identification of influential parent behaviours that may relate to preschoolers' physical activity levels. This study will help support the promotion of healthy growth and development among young Canadians. Please accept this gift certificate as a small token of our appreciation.

Sincerely,

Alana Maltby, BA (Hons.)
MSc Candidate
Health and Rehabilitation Sciences
Western University

Dr. Trish Tucker
Assistant Professor
School of Occupational Therapy
Western University

Appendix E - Poster Advertisement

Exploring the Influence of Mothers on Preschoolers' Physical Activity Levels



Our team at Western University is conducting a study on the physical activity levels of preschoolers' and their parents.

We are looking for:

Children ages 2.5 – 5 years and their mothers to participate in the study.

The study will occur in London and data collection will occur over 7 days.

Tokens of appreciation will be provided.

IF INTERESTED, PLEASE CONTACT:

Alana Maltby (MSc Candidate)

Appendix F - Email Recruitment

Email Script for Recruitment

Subject Line: Invitation to participate in research

You are being invited to participate in a study that we, Alana Maltby (MSc Candidate) and Dr. Trish Tucker are conducting. Briefly, the study involves you and your child wearing an accelerometer (a small, motion sensor device) during all waking hours for 7 consecutive days. A pager-like device in size, the accelerometer would be worn on an adjustable elastic belt around the waist (over top of clothing) to collect information about the amount and intensity of yours and your preschoolers' movement. In addition, we ask that a parent complete the adapted Environmental Determinants of Physical Activity in Preschool Children Parent Survey.

If you would like more information on this study or would like to receive a letter of information [if not already attached to this email] about this study please contact the researcher at the contact information given below.

Thank you,

Alana Maltby, BA (Hons.)
MSc Candidate - Health Promotion
Health and Rehabilitation Sciences

Appendix G - Accelerometer Log



Accelerometer Wear Time Log

Participant ID # _____ Actical # _____

	<i>Example</i>	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7
Date	July 2, 2014							
Time ON in morning	7:12 am							
Other times taken OFF during day (e.g., naps, swimming) ON/OFF	Nap Time 1:00 - 2:14pm							
Time OFF at bed time	8:20 pm							

Appendix H - Adapted Environmental Determinants of Physical Activity in Preschool Children - Parent Survey

ID: _____

Date: _____

Instructions: The following survey includes two sections (Demographic Information and Parental Influence). Please select the most appropriate response that best describes yourself, other care-giving adults in the home, and your child. As your participation in this study is voluntary, you may choose not to answer certain questions or withdraw at any time. Thank you for participating and completing the questionnaire.

DEMOGRAPHIC INFORMATION

Q-1. What is your child's birth date? _____month _____day _____year

Q-2. What is your child's sex? Male Female

Q-3. What is your child's height? _____feet _____inches OR _____cm

Q-4. What is your child's weight? _____pounds OR _____kg

Q-5. Currently, does your child have any medical conditions or disabilities that limit his or her physical activity (including Attention Deficit Hyperactivity Disorder)?

1. No

2. Yes, please specify:

Q-6. What is your current family arrangement?

- ☐ Two-parent household
- ☐ Single-parent household
- ☐ Grandparent(s)
- ☐ Foster parent(s)
- ☐ Other

Q-7a. What is your current childcare arrangement?

- ☐ Home childcare
- ☐ Centre childcare
- ☐ Preschool
- ☐ With parent
- ☐ With family member
- ☐ School
- ☐ Nanny/babysitter
- ☐ My child receives childcare in more than 1 of the above settings

Q-7b. Is the childcare arrangement: Full-time? Part-time?

Q-8. How would you describe your child's racial or ethnic background? (Please select one)

- ☐ Caucasian
- ☐ African Canadian
- ☐ Native/ Aboriginal
- ☐ Arabic
- ☐ Latin-American
- ☐ Asian
- ☐ Other (please specify)_____

Q-9. How many other children live in your household:

_____ male _____ female

Q-10. How many adults (over 18 years old), including yourself, live in your household:

_____ male _____ female

PLEASE ANSWER THE FOLLOWING QUESTIONS FOR YOURSELF AND OTHER ADULTS IN YOUR HOUSEHOLD.

Q-11a. Which of the following age groups includes **your** age?

Under 25 25 – 34 35 – 44 45 – 54 55 – 64 65 – 74 75 or over

Q-11b. Which of the following age groups includes the age of the **other primary care giving adult** in your household? If no other adult lives in your household, please leave this question blank.

Under 25 25 – 34 35 – 44 45 – 54 55 – 64 65 – 74 75 or over

Q-12. How would you describe **your** racial or ethnic background? (Please select one)

- ☐ Caucasian
- ☐ African Canadian
- ☐ Native/ Aboriginal
- ☐ Arabic
- ☐ Latin-American
- ☐ Asian
- ☐ Other (please specify)_____

Q-13. How would you describe the racial or ethnic background of **your spouse or other primary care giving adult who lives in your household**? (Please select one)

- ☐ Caucasian
- ☐ African Canadian
- ☐ Native/ Aboriginal
- ☐ Arabic
- ☐ Latin-American
- ☐ Asian
- ☐ Other (please specify)_____

Q-14. What is your relationship to the child participating in the current study? (Please select one only)

- | | |
|--------------------------------------|--|
| <input type="checkbox"/> Mother | <input type="checkbox"/> Grandfather |
| <input type="checkbox"/> Stepmother | <input type="checkbox"/> Other adult female relative |
| <input type="checkbox"/> Father | <input type="checkbox"/> Other adult male relative |
| <input type="checkbox"/> Stepfather | <input type="checkbox"/> Legal guardian |
| <input type="checkbox"/> Grandmother | |

Q-15. Please indicate the relationship of the other care giving adult living in your household to the child participating. Please select **Not Applicable** if there are no other adults living in your household.

- | | |
|--------------------------------------|---|
| <input type="checkbox"/> Mother | <input type="checkbox"/> Other adult female relative |
| <input type="checkbox"/> Stepmother | <input type="checkbox"/> Other adult male relative |
| <input type="checkbox"/> Father | <input type="checkbox"/> Other non-related female adult |
| <input type="checkbox"/> Stepfather | <input type="checkbox"/> Other non-related male adult |
| <input type="checkbox"/> Grandmother | <input type="checkbox"/> Not applicable |
| <input type="checkbox"/> Grandfather | |

Q-16a. For **yourself**, indicate the highest level of education completed.

- ☐ High School
- ☐ College
- ☐ University
- ☐ Graduate School
- ☐ Other

Q-16b. For the **other care-giving adult** living in your household, indicate the highest level of education completed. If no other adult lives in your household, please leave this question blank.

- ☐ High School
- ☐ College
- ☐ University
- ☐ Graduate School
- ☐ Other

Q-17a. Please indicate **your** current employment status.

- ☐ Not working
- ☐ Retired
- ☐ Homemaker, raising children, care of others
- ☐ Employed (full-time or part-time)
 - ☐ Full-time
 - ☐ Part-time
- ☐ Disabled, unable to work
- ☐ Other (please specify): _____

Q-17b. Please indicate the employment status for the **other care-giving adult** living in your household. If no other adult lives in your household, please leave this question blank.

- ☐ Not working
- ☐ Retired
- ☐ Homemaker, raising children, care of others
- ☐ Employed (full-time or part-time)
- ☐ Disabled, unable to work
- ☐ Other (please specify): _____

Q-18. What is your household income?

- ☐ Less than \$20,000
- ☐ \$20 000 - \$39,999
- ☐ \$40 000 - \$59,999
- ☐ \$60 000 - \$79,999
- ☐ \$80 000 - \$99,999
- ☐ \$100 000 - \$119,999
- ☐ \$120 000 - \$149,999
- ☐ More than \$150,000
- ☐ Prefer not to answer

PARENTAL INFLUENCE QUESTIONS

Q-19. Compared to other children of the same age and sex, how would you describe your child's level of physical activity? (please circle the most appropriate response)

Much less than others Somewhat less than others About the same Somewhat more than others Much more than others

Q-20. In your opinion, does your child generally get more than enough, about the right amount, or not enough physical activity? (Please circle one)

More than enough About the right amount Not enough

Q-21. How much does your child enjoy physical activity? (please circle the most appropriate response)

Not enjoyable A little enjoyable Neutral Somewhat enjoyable Very enjoyable

Q-22. What does your child usually do when he or she has a choice about how to spend their free time?

- ☐ Almost always chooses sedentary activities, such as watching TV, playing video games, or reading.
- ☐ Usually chooses sedentary activities, such as watching TV, playing video games, or reading,
- ☐ Just as likely to choose physically active play as inactive recreation
- ☐ Usually chooses physically active play, such as playing outside, crawling, running, or dancing
- ☐ Almost always chooses physically active play

Q-23. On an average **WEEK** day (Monday-Friday), how many hours does your child watch TV or play video games?

- ☐ Less than 1 hour per day
- ☐ Between 1 and 2 hours per day
- ☐ Between 2 and 3 hours per day
- ☐ Between 3 and 4 hours per day
- ☐ Between 4 and 5 hours per day
- ☐ More than 5 hours per day

Q-24. On an average **WEEKEND** day (Saturday and Sunday), how many hours does your child watch TV or play video games?

- ☐ Less than 1 hour per day
- ☐ Between 1 and 2 hours per day
- ☐ Between 2 and 3 hours per day
- ☐ Between 3 and 4 hours per day
- ☐ Between 4 and 5 hours per day
- ☐ More than 5 hours per day

Q-25. Do you sit with your child when watching TV or videos?

Never	Very Infrequently	Occasionally	Almost Daily	Daily
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Q-26. Does your child use an outdoor play area (e.g., backyard, apartment playground) at your residence? (Please circle one)

YES NO

Q-27. If YES, how many days per week does your child use the outdoor play area? (Please circle one)

0 1 2 3 4 5 6 7

Q-28. Please list any physical activity equipment **you** use to be active at home (e.g., basketball, fitness videos, treadmill, roller blades, big backyard, etc.)

Q-29. Please list any physical activity equipment **your child** uses to be active at home (e.g., tricycle, jungle gym, swimming pool, sandbox, etc.)

Q-30. How far from your home is the nearest park where your child can be physically active or play sport?

- ☐ 1-2 blocks
- ☐ 3-4 blocks
- ☐ 2 kilometers
- ☐ 3 kilometers
- ☐ 4-5 kilometers
- ☐ More than 5 kilometers

Q-31. The nearest park has a reputation of being: (please circle the most appropriate response)

Very unsafe Somewhat unsafe Neutral Somewhat safe Very safe

Q-32. How often do you take your child to this park per month? (Please circle one only)

Never 1-2 times 3-7 times 8-14 times 15 or more

ANSWER THE FOLLOWING QUESTIONS FOR YOURSELF AND THEN FOR ANY OTHER MEMBERS OF YOUR HOUSEHOLD. IF NO ONE OF THAT TYPE OF PERSON LIVES IN YOUR HOUSEHOLD, LEAVE THAT SECTION BLANK. AN ADULT IS ANYONE OVER THE AGE OF 18.

Q-33 - During a typical week how often do you: (please put a checkmark in the appropriate box)

	Never	Once	Sometimes	Almost daily	Daily
a. Encourage your child to do physical activity or play outside?					
b. Play outside or do physical activity with your child?					
c. Provide transportation to a place where he or she can do physical activity or play?					
d. Watch your child participate in physical activities or outdoor games?					
e. Tell your child that physical activity is good for his or her health?					

OTHER ADULT: leave blank if no other adult lives in your household

Q-34 - During a typical week how often do they: (please put a checkmark in the appropriate box)

	Never	Once	Sometimes	Almost daily	Daily
a. Encourage your child to do physical activity or play outside?					
b. Play outside or do physical activity with your child?					
c. Provide transportation to a place where he or she can do physical activity or play?					
d. Watch your child participate in physical activities or outdoor games?					
e. Tell your child that physical activity is good for his or her health?					

PLEASE CIRCLE THE BEST ANSWER FOR YOURSELF FOR EACH QUESTION AND THEN ANSWER FOR OTHER ADULTS IN YOUR HOUSEHOLD. IF THERE ARE NO OTHER ADULTS IN YOUR HOUSEHOLD, PLEASE LEAVE THAT SECTION BLANK.

Answer for yourself:

Q-35a. How important is it to you that your child participates in sports and physical activities?	Very unimportant	Somewhat unimportant	Neutral	Somewhat important	Very important
Q-35b. How much do you enjoy participating in sports or exercise?	Not enjoyable	A little enjoyable	Neutral	Somewhat enjoyable	Very enjoyable
Q-35c. How often does your child see or hear you talk about being physically active?	Never	Rarely	Sometimes	Almost daily	Daily

Answer for other care-giving adult: leave blank if no other adult lives in your household

Q-36a. How important is it to them that your child participates in sports and physical activities?	Very unimportant	Somewhat unimportant	Neutral	Somewhat important	Very important
Q-36b. How much do they enjoy participating in sports or exercise?	Not enjoyable	A little enjoyable	Neutral	Somewhat enjoyable	Very enjoyable
Q-36c. How often does your child see or hear you talk about being physically active?	Never	Rarely	Sometimes	Almost daily	Daily

PLEASE ANSWER THE FOLLOWING QUESTIONS ABOUT YOUR CHILD(REN)'S PARTICIPATION IN SPORTS.

Q-37. Within the past year, in how many organized sports and/or physical activities did your child participate? (Please circle one)

0 1 2 3 4 OR MORE

Q-38. Within the past year, how many of the other children who live in your household participated in organized sports and/or physical activities? (Please circle one)

0 1 2 3 4 OR MORE No other children in household

THE FOLLOWING QUESTIONS ASK ABOUT YOUR OWN PHYSICAL ACTIVITY.

- Q-39. On how many of the past 7 days did **you** exercise or participate in sports activities for at least 30 minutes that made you sweat and breathe hard, such as basketball, soccer, running, swimming laps, fast bicycling, fast dancing, or similar aerobic activities? (Please circle one)

0 days 1 day 2 days 3 days 4 days 5 days 6 days 7 days

- Q-40. On how many of the past 7 days did **you** participate in physical activity for at least 30 minutes that did NOT make you sweat or breathe hard, such as fast walking, slow bicycling, skating, pushing a lawn mower, or mopping floors? (Please circle one)

0 days 1 day 2 days 3 days 4 days 5 days 6 days 7 days

- Q-41. On how many of the past 7 days did **you** do exercises to strengthen or tone your muscles, such as push-ups, sit-ups, or weight lifting? (Please circle one)

0 days 1 day 2 days 3 days 4 days 5 days 6 days 7 days

- Q-42. Please rate **your own** physical activity level using a scale of 0 to 10. A 10 means "You are in such good shape, you could be training for the Olympics," and 0 means "You hardly get off the couch." (Please circle one number)

0 1 2 3 4 5 6 7 8 9 10

- Q-43. What is **your** height? _____feet _____inches

- Q-44. What is **your** weight? _____pounds

THE FOLLOWING QUESTIONS ASK ABOUT YOUR SPOUSE OR OTHER ADULT WHO LIVES IN YOUR HOUSEHOLD. PLEASE ANSWER FOR THE OTHER ADULT LIVING IN YOUR HOUSEHOLD WHO, BESIDES YOURSELF, IS MOST RESPONSIBLE FOR PROVIDING CARE FOR YOUR CHILD.

- Q-45. On how many of the past 7 days did **he/she** exercise or participate in sports activities for at least 30 minutes that made him/her sweat and breathe hard, such as basketball, soccer, running, swimming laps, fast bicycling, fast dancing, or similar aerobic activities? (Please circle one)

0 days 1 day 2 days 3 days 4 days 5 days 6 days 7 days

- Q-46. On how many of the past 7 days did **he/she** participate in physical activity for at least 30 minutes that did NOT make him/her sweat or breathe hard, such as fast walking, slow bicycling, skating, pushing a lawn mower, or mopping floors? (Please circle one)

0 days 1 day 2 days 3 days 4 days 5 days 6 days 7 days

- Q-47. On how many of the past 7 days did **he/she** do exercises to strengthen or tone his/her muscles, such as push-ups, sit-ups, or weight lifting? (Please circle one)

0 days 1 day 2 days 3 days 4 days 5 days 6 days 7 days

- Q-48. Please rate **his or her** physical activity level using a scale of 0 to 10. A 10 means "such good shape, he or she could be training for the Olympics," and 0 means "hardly gets off the couch." (circle one number)

0 1 2 3 4 5 6 7 8 9 10

Q-49. What is **their** height? _____feet _____inches or _____cm

Q-50. What is **their** weight? _____pounds or _____kg

THANK YOU FOR COMPLETING THIS SURVEY.

Appendix I - Characteristics of Preschoolers' Physical Activity and Sedentary Time as Described by Mothers

	<i>N</i>	<i>%</i>
How would you describe your child's activity compared to others?		
Somewhat less than others	1	3.3
About the same	14	46.7
Somewhat more than others	14	46.7
Much more than others	1	3.3
Does your child get enough physical activity?		
Not enough	8	26.7
About the right amount	22	73.3
How much does your child enjoy physical activity?		
Somewhat enjoyable	6	20.0
Very enjoyable	24	80.0
What do you think is the right amount of physical activity for your child?		
60 minutes per day	13	43.3
120 minutes per day	8	26.7
150 minutes per day	1	3.3
180 minutes per day	8	26.7
What does your child usually do when he or she has a choice about how to spend their free time?		
Almost always chooses sedentary activities	1	3.3
Usually chooses sedentary activities	6	20.0
Just as likely to choose physically active play as inactive recreation	13	43.3
Usually chooses physically active play	9	30.0
Almost always chooses physically active play	1	3.3
On an average WEEK day how many hours does your child watch TV or play video games?		

	<i>N</i>	<i>%</i>
Less than 1 hour per day	14	46.7
Between 1 and 2 hours per day	12	40.0
Between 2 and 3 hours per day	3	10.0
Between 3 and 4 hours per day	1	3.3
On an average WEEKEND day, how many hours does your child watch TV or play video games?		
Less than 1 hour per day	7	23.3
Between 1 and 2 hours per day	14	46.7
Between 2 and 3 hours per day	4	13.3
Between 3 and 4 hours per day	5	16.7
Do you sit with your child when watching TV or videos?		
Never	4	13.3
Very infrequently	6	20.0
Occasionally	13	43.3
Almost daily	5	16.7
Daily	2	6.7
Does your child use an outdoor play area (e.g., backyard, apartment playground) at your residence?		
Yes	28	93.3
No	2	6.7
If yes, how many days per week does your child use the outdoor play area?		
1 day	5	16.7
2 days	1	3.3
3 days	5	16.7
4 days	4	13.3
5 days	3	10.0
6 days	3	10.0
7 days	7	23.3
How far from your home is the nearest park where your child can		

	<i>N</i>	<i>%</i>
be physically active or play sport?		
1-2 blocks	16	53.3
3-4 blocks	13	43.3
2 kilometers	1	3.3
The nearest park has a reputation of being:		
Very unsafe	1	3.3
Neutral	5	16.7
Somewhat safe	10	43.3
Very safe	13	96.7
How often do you take your child to this park per month?		
Never	1	3.3
1-2 times	9	30.0
3-7 times	10	33.3
8-14 times	3	10.0
15 times or more	7	23.3
Within the past year, in how many organized sports and/or physical activities did your child participate?		
0	3	10.0
1	7	23.3
2	7	23.3
3	8	26.7
4 or more	5	16.7

Note: Some values shown in the table may not add up to 100% or $n = 30$ as some individuals chose not to answer certain questions.

CURRICULUM VITAE

PERSONAL INFORMATION

NAME: Alana Marie Maltby

PLACE OF BIRTH: London, Ontario

EDUCATION

2013 – 2015 M.Sc., Health and Rehabilitation Sciences (Health Promotion),
Faculty of Health Sciences, The University of Western Ontario.

2009 – 2013 Honours BA. Bachelor of Arts, Faculties of Psychology and
Health Sciences, The University of Western Ontario.

Masters Thesis Title

Exploring Mothers' Influence on Preschoolers Physical Activity Levels and Sedentary Time.

PUBLICATIONS

Maltby, A. (2014). Obesity Prevention Through Primary Health Care: Promoting Physical Activity in Early Childhood. *Health Science Inquiry*, 5(1), 83-84.

CONFERENCE PRESENTATIONS AND POSTERS

Maltby, A., Vanderloo, L., Tucker, P. Exploring Maternal Influences on Preschoolers' Physical Activity and Sedentary Time (2015). Poster presentation presented at the 14th Meeting of the International Society of Behavioral Nutrition and Physical Activity, Edinburgh, Scotland.

Maltby, A., Tucker, P. Exploring Mothers' Influences on Preschoolers' Physical Activity Levels (2015). Poster presentation presented at the Child Health Symposium, The University of Western Ontario, London, Ontario.

Maltby, A., Tucker, P. Exploring Mothers' Influences on Preschoolers' Physical Activity Levels (2015). Oral presentation presented at the Health & Rehabilitation Graduate Research Conference, The University of Western Ontario, London, Ontario.

Maltby, A., Tucker, P. Objectively Measured Physical and Sedentary Activity Levels of Preschoolers and Their Parents (2014). Poster presentation presented at the Canadian Obesity Student Meeting, University of Waterloo, Ontario.

Maltby, A., Tucker, P. The Influential Role Parents Have on their Preschoolers' Physical Activity Levels (2014). Oral presentation presented at the Child Health Symposium, Thames Valley Children's Centre, London, Ontario.

Maltby, A., Tucker, P. Parental Influence on Preschoolers' Physical Activity Levels (2014). Oral presentation presented at the Health & Rehabilitation Graduate Research Forum, The University of Western Ontario, London, Ontario.

TEACHING EXPERIENCE

Teaching Assistant September 2014 – April 2015
Professionalism for Occupational Therapy
 Occupational Therapy, The University of Western Ontario, London, Ontario

Teaching Assistant and Tutorial Instructor January 2014 – April 2014
Introduction to Ethics and Health
 School of Health Studies, The University of Western Ontario, London Ontario

RELATED WORK EXPERIENCE

Research Assistant April 2014 – July 2015
 The SPACE Study - Child Health and Physical Activity Lab
 The University of Western Ontario, London Ontario
 Responsibilities:

- Helped with document preparations (e.g., photocopying, collating, etc.) and logistics planning
- Supported recruitment activities (such as dropping off/picking up consent forms)
- Assisted with pre- and post-intervention data collection and data entry
- Took preschoolers' height, weight and waist circumference measurements and calculated BMI z-scores and percentiles
- Programmed Actical accelerometers and downloaded participant physical activity data

Research Assistant May 2014 – June 2014
 School of Occupational Therapy and the Department of Geography
 The University of Western Ontario, London Ontario
 Responsibilities:

- Assisted with the identification of relevant abstracts and articles for a scoping literature review based on inclusion criteria developed by the research team
- Extracted required information from the articles and summarized it in an Excel spreadsheet

Volunteer Research Assistant

March 2012 – April 2013

Esses Lab for the Study of Intergroup Relations

The University of Western Ontario, London Ontario

Responsibilities:

- Handled running participants through psychology studies focusing on stereotyping, discrimination, and dehumanization
- For each study I coordinated time slots, provided an overview of the study and gathered consent forms, collected and recorded data, and debriefed participants.

PROFESSIONAL AFFILIATIONS

Canadian Public Health Association

August 2015 – Present

Student Member

Ontario Public Health Association

August 2015 – Present

Student Member

ISBNPA

May 2015 – Present

Student Member

Sedentary Behaviour Research Network

January 2015 – Present

Student Member

Health Promotion Ontario

November 2013 – Present

Student Member

Canadian Obesity Network

October 2012 – Present

Student Member